

## Suggested Goal: DOT Standard for DSRC

- ✓ Do old functions in new way
  - i.e. Toll Collection
- ✓ Do New function not possible before
  - i.e. road / vehicle communication

5.9 GHz Stakeholders Workshop / 16 Dec 99



## Thank You

5.9 GHz Stakeholders Workshop / 16 Dec 99



**TRANSIT DSRC INTEREST**

**5.9 GHz STAKEHOLDERS WORKSHOP**

**FOR ITS APPLICATIONS**

December 16-17, 1999

Prepared for Federal Transit Administration

Joseph LoVecchio

DOT Volpe Center

# **Types of Transit DSRC Applications**

- Download bus stored data at garage
  - passenger counts
  - fare collection
  - bus operational data
- Traffic signal priority
- Access to toll roads, facilities, parking lots

# **New Jersey Transit**

## **Current DSRC use:**

- Access to toll roads, bridges, tunnels, express lanes
- Traffic management information

## **Would like to use DSRC for:**

- Download bus stored data at terminal

# **Seattle - King County Transit**

## **Current DSRC use:**

- Signal priority

## **Would like to use DSRC for:**

- Download bus stored data at terminal

# Chicago Transit Authority

## Current DSRC use:

- None

## Would like to use DSRC for:

- Download bus stored data at terminal
- Access control to property
- Last minute route, schedule changes as bus departs lot

# **Houston - Metropolitan Transit Authority**

## **Current DSRC use:**

- Toll Collection
- HOV access control

## **Would like to use DSRC for:**

- Download bus stored data at terminal

# **Sample of Transit Market**

- **Signal Priority Systems**
  - 23 agencies operational or being implemented
  - 33 agencies planning
- **Automatic Passenger Counters Systems**
  - 30 agencies operational or being implemented
  - 34 agencies planning



## **Other Applications Under Consideration**

- Bus monitoring/identification at Natural Gas bus fueling depots
- Rail grade crossing warning for bus/vehicles
- Vehicle to vehicle fleet management applications

## Summary

- There is significant transit interest in DSRC
- Widespread application has been limited by current bandwidth limitations, interference, lack of equipment interoperability
- The transit community supports the development of standards for 5.9 GHz DSRC

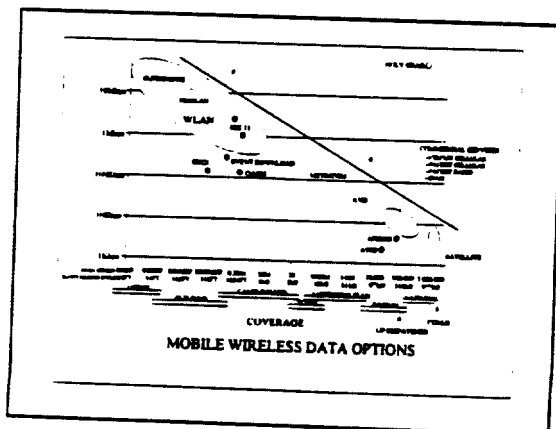
## 5.9 GHz Stakeholders Workshop

"Fleets" - Railroad  
Howard G. Moody  
Association of American Railroads

December 16, 1999

### Background

- Railroads already have a one-way "AEI" tag for car (shipment) tracking using backscatter technology
- Have future data needs that may require larger file transmission and short range two-way communications
- Railroads have a several wireless communications networks, but are looking for "options" in the future



### General Application

- Would supplement AEI for large file transfer
- Would require transmission both to and from mobile vehicle (locomotive) at low speed
- Would be located in or near yards/terminals
- Would need railroad specific messages but use DSRC protocol

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### Typical Railroad Application

- Event recorder download where information on train /locomotive performance over last 24 hours is downloaded
  - Mbytes of information
  - done at low speed - 5 MPH
  - single vehicle
  - maximum range 200 feet
  - two tracks

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### DSRC Advantages for Railroads

- Can accommodate large file transactions
- low cost implementation on vehicles
- large market (highway) for products to reduce cost for small market (railroads)
- non-interfering, and don't have to compete/pay for spectrum

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### Status

- Looking at a host of alternatives for large file transfer to/from mobile, but no decisions have been made - more of a future system use
- Have an industry task force looking at potential wireless applications and technology
- ARINC provides substantial contractor support - so we are/will be aware of DCRC developments

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## **A Vendor Perspective**

Some Thoughts  
for the  
5.9 GHz Stakeholder Workshop  
December 16-17, 1999

Dick Schnacke  
Intermec / Amtech Systems Division

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## **Vendors - A huge stake**

- ▼ Nobody cares more than DSRC vendors about:
  - how DSRC fares in the big ITS communications land grab
  - whether new ITS applications become real
  - how the 915 MHz vs 5.9 GHz shootout ends
- ▼ These things size our markets and scope our activities
- ▼ Vendors face crucial decisions today
  - and they have to bet the ranch on some of them (or at least the south forty)

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## Vendor issues du jour

- ▼ Old 915 MHz vs new 915 MHz
- ▼ Either 915 MHz choice vs 5.9 GHz
- ▼ Single-mode vs multi-mode devices
- ▼ Support a few (core) services vs multi-appl.
- ▼ Stand-alone vs integrated onboard units
- ▼ IDB wireless link ?
- ▼ Technical: speed, range, data rate, etc.
- ▼ Customer migration
- ▼ A global market
- ▼ Liability (safety applications)
- ▼ Cost, cost, cost, cost

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## Perceptions

	<u>915 MHz</u>	<u>5.9 GHz</u>
▼ Technology	Old	New
▼ Interference	Getting worse	No problems
▼ Range	OK for toll, BUT	Allows new applications
▼ National Interoperability	Doomed by legacy	Possible
▼ Migration	Difficult	Easy
▼ Cost	Not worth an upgrade	May be worth it
▼ Destiny	Will fade away	The FUTURE

- ▼ Are these perceptions justified?

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## Why move to 5.9 GHz?

▼ If the applications of the future are the same as the applications of today - there is no real reason to leave 915 MHz.

- It works fine
- No unworkable interference - and none expected that we can't deal with
  - Change channels, Increase power
- Worst case - improve filtering & sensitivities (much cheaper than developing 5.9 GHz solutions)
- It's inexpensive

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## ETTM--It's Everywhere



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## Many Markets Currently Served



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## Why move to 5.9 GHz?

- ▼ There are only a few reasons to consider moving from 915 MHz to 5.9 GHz
  - Bandwidth for more applications
  - Protection for safety services
  - A 'fresh start' toward interoperability
- ▼ Everything else works to favor 915 MHz
  - The physics
  - Migration
  - Cost

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## **You Can't Beat the Physics**

### **▼ Signal Attenuation**

- For same power, more attenuation = less range
- Adequate range is especially important in high speed, long range applications
- 915 MHz
  - Low atmospheric attenuation = Good range
- 5.8 GHz
  - Higher atmospheric attenuation = Lower range

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## **You Can't Beat the Physics (cont.)**

### **▼ Signal Fading**

- Fading effects are proportional to frequency
- Directly affects the reliability of data transfer
- Faded transmissions require re-send of data
- 915 MHz
  - Moderate fading occurs
  - Re-send occasionally necessary
- 5.8 GHz
  - Serious fading occurs: Re-send OFTEN necessary
  - Theory: 7 times worse than 915 MHz
  - Empirically: 3-4 times worse

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## **You Can't Beat the Physics (cont.)**

### **▼ Microwave Line Losses**

#### **➤ 915 MHz**

- Losses are low
- RF source-to-antenna distances up to 200 feet
- Allows all maintainable components to be conveniently located at ground level in safe, clear areas

#### **➤ 5.8 GHz**

- Losses are high
- RF source-to-antenna distances must be very short
- Requires RF components be located over the lane
- Maintenance requires either very large, strong man-rated antenna structures or lane closure & man-lift

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## **You Can't Beat the Physics (cont.)**

### **▼ Antenna Pattern**

- Small pattern = small communication zone
- Small comm zone = short comm time
- Advanced ITS applications require more time

#### **➤ 915 MHz**

- Inherently large (floodlight) pattern

#### **➤ 5.8 GHz**

- Inherently small (spotlight) pattern
- Very short time to complete transaction
- More hardware needed to cover the roadway

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## **Why move to 5.9 GHz?**

- ▼ If we're serious about implementation of multiple new applications/services - especially safety services:

It MUST be 5.9 GHz

- Bandwidth
- Protection (primary status)
- Performance improvements

- ▼ So....if we're serious about moving beyond conventional services....the 915 vs 5.9 decision should be easy.

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## **The market wants more performance**

- ▼ Support for multiple applications
- ▼ More range
- ▼ Ability to handle more data
  - memory
  - data rate
- ▼ More security
- ▼ More features

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## Perceptions

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## Reality

Higher frequency	=	More cost
Longer range	=	More cost
Higher data rate	=	More cost
Multi-appl. capability	=	More cost
More security	=	More cost
More features	=	<u>More cost</u>
TOTAL	=	Lots more cost

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## How much is 'lots more' ?

- ▼ Best industry guesses today are:
- ▼ Basic 'low-end' tags: 2X - 3X
- ▼ Do-it-all 'high-end' tags: 5X

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## Cost - a big concern

- ▼ 5.9 GHz product development costs (NRE) will be high
- ▼ DSRC has been a cost-driven industry (especially transponder prices)
- ▼ How much is too much cost?
- ▼ Will the market accept the cost?

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**But.....it's 5.9 GHz !**

Customers  
don't  
care !!

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**What's required to make this work?**

- ▼ VALUE to the customer has to increase proportional to cost
- ▼ MULTIPLE APPLICATIONS have to be there to justify additional cost
- ▼ User has to be given the opportunity to SELECT more capability for more cost

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## **Value**

- ▼ A value benchmark has been established
- ▼ Added value might include:
  - more electronic payment opportunities
  - enroute traveler information
  - safety services
  - nationwide interoperability
- ▼ If new devices cost more, they should offer:
  - more capabilities
  - more features
  - more pizzazz

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## **Servicing REAL applications**

- ▼ The chicken & egg dilemma:
  - Capable tags won't proliferate until a multi-service infrastructure appears
  - Hard to rationalize the infrastructure costs without a universe of capable tags
- ▼ The end-user will not break this cycle - it must be solved on the institutional side.
- ▼ Availability of services will pull capable tags into circulation.

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## Letting the Customer Decide

### ▼ Who is the customer?

- Traditionally - a service provider (toll authority, etc.) who installs infrastructure & resells tags. No choices are offered. Only one service is provided & the tag is simple.
- The future - Tag customer should be the end user who knows what services he's interested in and buys an appropriate device from offered choices.

### ▼ How can the business model be changed?

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## The Quiz

Answers  
to the  
Posed Questions

***\*\*\*Answers have been augmented with  
audience feedback***

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## Question #1

▼ What applications, using short-range wireless communications, are expected to be commercially available:

- Within one year - Same ones we have today
  - Toll. Border clearance. Parking. Taxi/Limo control at airports. Shell Oil: diagnostics from engine controllers. CVO mainline screening, priority control of traffic signals, traffic probes (TransCom). CVO/port/transit yard control. [other fleet management applications (dispatcher communications)]. fuel transactions

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## Q1 Continued

▼ Within 1-3 years - Today + expanded payment systems + vehicle registration (VIN related; Electronic Lic. Plate)+ early transit data systems + (rudimentary) pilot safety systems

- Vehicle-Vehicle communications
- Dynamic data off vehicle databus
- ATIS delivery (real time)
- Cargo container ID for intermodal freight; baggage monitoring, waste management, vehicle emissions
- Safety warning systems (e.g., Highway-Rail Intersections)

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